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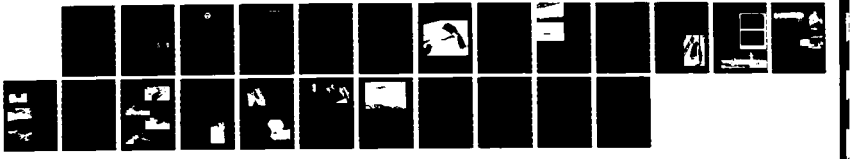

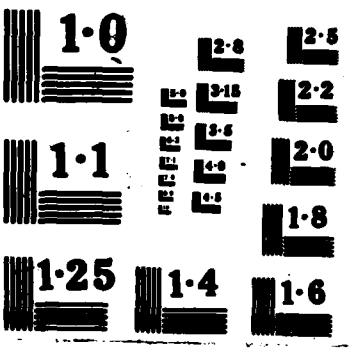
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Technical Report 811

CAPTURE, TRANSPORT, AND INITIAL ADAPTATION OF BELUGA WHALES

C. A. Bowers
R. E. Austin

1 May 1983

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NOSC

NAVAL OCEAN SYSTEMS CENTER
San Diego, California 92152

NAVAL OCEAN SYSTEMS CENTER, SAN DIEGO, CA 92152

AN ACTIVITY OF THE NAVAL MATERIAL COMMAND

JM PATTON, CAPT, USN
Commander

HL BLOOD
Technical Director

ADMINISTRATIVE INFORMATION

The work reported upon here was conducted by the Naval Ocean Systems Center as part of the Advanced Marine Biological Systems Program, sponsored by the Naval Sea Systems Command.

Work on the beluga whale program began in 1977. Three whales were captured at Churchill, Canada, in July of that year. They completed adaptation and began hand-feeding over 3 months later. Three more belugas were collected in July and August of 1980 and reached a similar stage in the adaptation process in less than 2 months. The capture methodology and transport techniques used for these two groups of beluga whales and their initial adaptation to captivity are documented in this report.

This report was reviewed for technical accuracy by F.G. Wood, Dr. C.S. Johnson, and Dr. S.H. Ridgway.

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Six beluga whales were collected for use in research and development programs aimed at exploring the capabilities of different species of marine mammals. Experiences with the whales verified the importance of the early initiation of force-feeding procedures, since newly captured belugas are reluctant to feed on their own when transported to a different environment.

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SUMMARY

The Naval Ocean Systems Center (NOSC) collected six beluga whales *(Delphinapterus leucas)* from Churchill, Canada. The first three whales were collected in 1977 and the last three in 1980. The whales were collected for use in research and development programs aimed at exploring the capabilities of different species of marine mammals.

This report describes the capture, transport, and initial adaptation of the whales. The first three whales took over 3 months to complete adaptation and begin hand-feeding well. The second group took less than 2 months to reach that same stage, partly because they were younger than the first group and partly because they benefitted from handling and feeding techniques that were developed with the first group. This adaptation period can be reduced even further if the whales are housed in individual enclosures, because when they are placed in a common pen they interfere with each other or "school up" to avoid human contact.

Experiences with the six NOSC beluga whales verified the importance of the early initiation of force-feeding procedures, since newly captured belugas are reluctant to feed on their own when transported to a different environment.

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Beluga whale stationing in floating bay pen.

INTRODUCTION

PURPOSE

The purpose of this report is to document the capture, transport, and initial adaptation of beluga whales (*Delphinapterus leucas*) by the Naval Ocean Systems Center (NOSC).

BACKGROUND

NOSC has conducted research and development programs with numerous marine mammal species (Ref. 1-9). These research activities, designed to explore marine mammal behavioral, physiological, psychological, and sensory capabilities, contribute to the body of scientific knowledge about marine mammal species, especially as pertains to their behavioral or physiological limitations (e.g., some marine mammals cannot dive as deep, hear as well, or swim as fast as others; some can tolerate extreme temperature changes, and some cannot; some can survive for long periods in fresh water and some cannot).

Observations of, and data on, both wild and captive belugas indicate that they possess a number of unique abilities. In fact, evidence indicates that they have some behavioral and physiological capabilities that in certain environments enable them to outperform a number of other marine mammals studied by NOSC. For example, beluga whales have no cold-water limitations (Fig. 1), can navigate under extremely turbid conditions, can tolerate fresh water for long periods, will readily swim in shallow water (Fig. 2), and can maneuver easily in ice fields and around such obstructions as sand bars and floating debris. Before the NOSC beluga whale program, there were insufficient data on the trainability, echolocation potential, and deep-diving and hearing abilities of the belugas. Project Cold Ops was initiated to determine the beluga's adaptation and husbandry requirements, its trainability, and its deep-diving and echolocation abilities.

The major goals, milestones, and behaviors to be trained and tested in Project Cold Ops were defined in a program plan. Included in this plan were capture, handling, and transport requirements for the acquisition of belugas. As a prelude to animal capture, permits were required to obtain and hold belugas. It took from early 1977 to July 1977 to obtain the necessary permits. By the time the U. S. permit was issued, time factors had become so critical (because of the seasonal availability of the animals) that NOSC personnel were required to hand-carry the U. S. permit to Canada. Canadian officials had processed the NOSC permit request and were simply awaiting verification that the U. S. permits were in hand. Formal documentation was exchanged and approval granted to proceed with the collecting operation in Churchill, Canada, the area from which most beluga collecting operations are conducted. This area was formerly a large commercial beluga whale fishery (Ref. 10 and 11).

SCOPE AND APPROACH

This report will cover the period beginning with the acquisition of permits to start capture operations in the Hudson Bay, Churchill River area in Canada and ending with the move of the whales from the tanks at the NOSC Marine Sciences Laboratory to the

Figure 1. Belugas turning back out of obstructed lead in ice pack. (Provided by Don Ljungblad.)

floating pens at the bayside facility in San Diego Harbor.

The approach to be followed will basically be a chronology of events. Comments as appropriate, however, will be inserted to flesh-out this report. Detailing the day-to-day activities with the beluga whales will not be attempted. Those activities were logged in daily and are summarized in monthly reports. Excerpts of some of those reports are included in the appendix to provide an overview of the adaptation phases with the first three whales. Since the first group of whales presented the most extreme adaptation example, their chronology will be used.

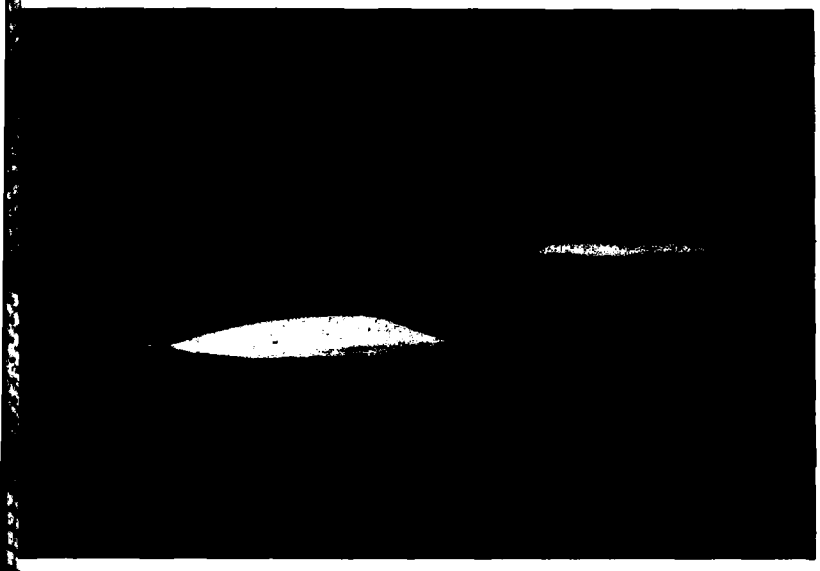

Figure 2. Belugas swimming near shore in Hudson Bay near the mouth of the Churchill River. Normally only the whale's dorsal ridge is visible when it surfaces.

PRELIMINARY TASKS

This section of the report details the precapture tasks that were a necessary adjunct to the capture and transport of the beluga whales.

PERMITS

United States

Attempts to obtain the necessary U. S. permits for the capture of belugas started approximately 6 months before the anticipated capture in July 1977. The process was complicated because the designated capture was to take place outside the United States. Initially, information on the size of stocks (number of animals available) was lacking for the region selected for capture. Permit acquisition was further complicated by the short collecting season (June through August). After that time, the whales begin migrating out of the rivers feeding into Hudson Bay. Permit requirements of the U. S. National Marine Fisheries Service (NMFS) were satisfied and a permit was issued in early July, only a few days before collection was scheduled to begin.

Canada

Preliminary contacts between NOSC and the Canadian Fisheries and Oceans Department indicated that the Canadian permits would be issued promptly when the U. S. permit was made available to Canadian authorities. In mid-July, the Canadian permit was picked up in Ottawa and hand-carried to Churchill, Manitoba, Canada, where collecting operations were set to begin.

SELECTION OF ANIMAL CAPTURE SITE

Two geographic areas were initially considered for beluga capture. At the first location, Alaska's Kvichak River, large numbers of belugas are known to frequent streams during salmon runs in early spring. No collector operated in that area, however, so only in-house NOSC personnel could have been used for the capture operations. Substantially more logistics and coordination would have been required to operate there. Nevertheless, that area may be a good prospect for future collections now that NOSC personnel have acquired experience in collecting belugas.

The second area considered for beluga collection was Churchill, Canada. The majority of, if not all, the belugas currently in captivity have been captured in Churchill by Nanuk Enterprises. That area is particularly well-suited for collecting operations for several reasons: the expertise of the collectors, an extensive shoreline with shallow water where the whales can be stranded, the availability of facilities and nearby logistics support, and apparently a longer collecting season. Initially, it was felt that collecting outside the United States might be disadvantageous. But that assumption proved to be incorrect since the Canadian Government was very cooperative. A contract was negotiated and awarded to Nanuk Enterprises in Churchill, with the assistance of the Canadian Fisheries and Oceans Department, to capture beluga whales for NOSC.

TRANSPORT ARRANGEMENTS

Aircraft

A C-9 aircraft was requested for the whale transport. NOSC made the necessary arrangements for the aircraft assignment with the Naval Air Station (NAS) Alameda, California. The plan was for the aircraft to arrive at NAS North Island, load transport equipment and NOSC personnel, then fly to Churchill, Canada. The captured animals would be loaded the following morning and then the plane would fly from Churchill back to NAS North Island.

Transport Equipment

Based upon past captures and the transportation of animals, it was felt that the equipment listed in Table 1 was necessary for the safe transport of the beluga whales. The main items of equipment were transport containers and stretchers. Large wooden boxes served as transporters, each being 12 feet long by 3 feet wide by 4 feet high. They were designed to support loads of 7,000 pounds and were waterproofed with custom-built heavy duty nylon-reinforced plastic liners. The transport boxes were constructed with 3/4-inch plywood sheets. Supporting frame members consisted of 2 by 4, 2 by 6, 2 by 8, and 4 by 4 pine boards.

Table 1. List of equipment for the transport of beluga whales.

Equipment	Amount
Barrel pumps	1
Transporters	3
Stretchers	3
Foam pads	18
Stretcher poles	6
Liners	3
Hudson sprayers	3
Plastic trash cans with lids	4
55-gallon water drums	4
Bilge pumps	2
Terry cloth	25 yards
Nylon slings	6
Shackles	12
Flashlights	2
Tool box and tools	1
Plastic bags	1 dozen
Parachute cord	1 roll

Most of the whale-handling and transport equipment was assembled or constructed a month or more before each transport. Stretchers were designed and constructed to provide maximum comfort for the whales while they were being moved. The load-carry fabric was #7 duck grade canvas. Each stretcher was lined with synthetic sheep's wool, a material often used in hospitals to support burn patients (see Fig. 3). That material is soft and nonabrasive and allows air or water circulation next to the skin.

Figure 3. Beluga in transporter lined with synthetic sheep's wool.

CAPTURE OF THE ANIMALS

From June through August, beluga whales can be found in many rivers which feed into the Hudson Bay (see Fig. 4). One of these, the Churchill River, which is approximately 1½ miles wide at the mouth, is inhabited by large numbers of belugas during the spring and summer seasons. They swim up-river several miles during high water, retreating to mid-channel near the river mouth or out into Hudson Bay at low tide.

Animal capture operations are normally conducted at high tide when the whales are found swimming near shore. Working together, several small outboard-powered canoes maneuver the whales into shallow water. Three people usually man each canoe – a jumper, a backup jumper, and a boat operator (Fig. 5). For the actual capture, the whale is driven toward the shore (Fig. 6) and a man positioned at the canoe's bow (the jumper) leaps onto the animal and attempts to secure a lasso around its head (Fig. 7). Several other personnel from nearby canoes immediately enter the water to help restrain the whale, which is then maneuvered onto a stretcher and secured alongside a large canoe for transport to the holding facility. Normally all animal handling, such as securing and lifting, is done by hand. The whales are often brought ashore where mechanized equipment cannot operate.

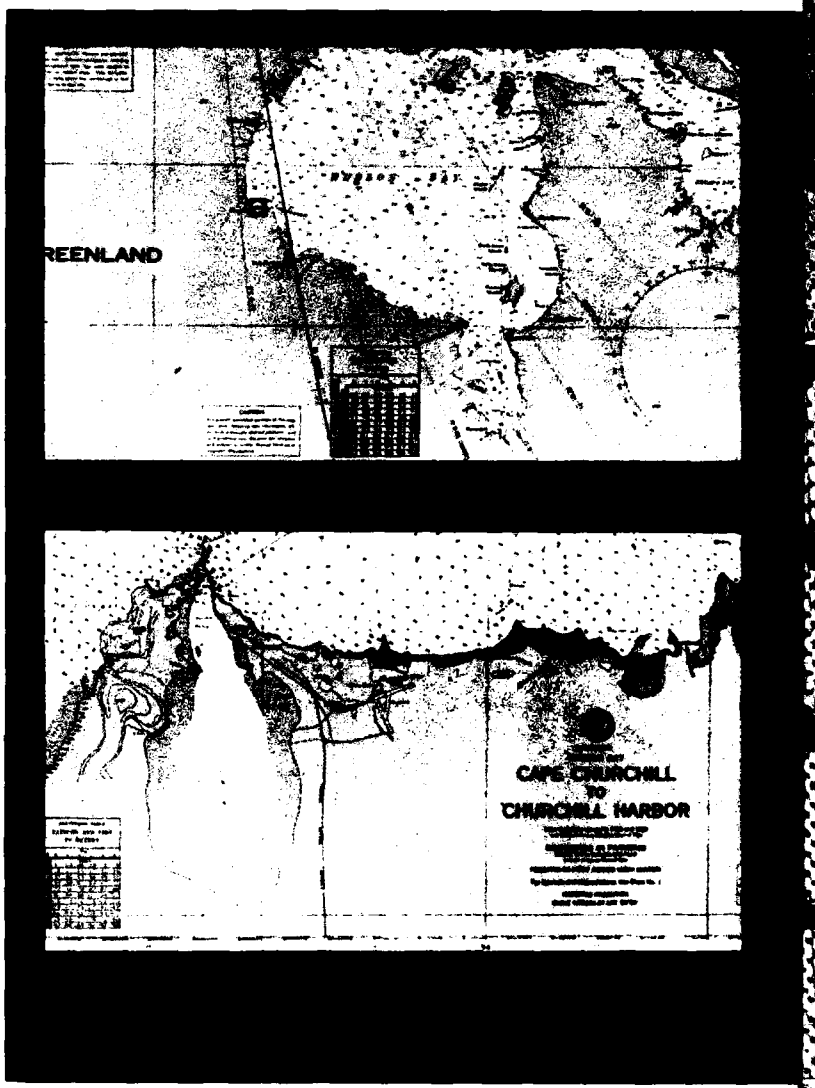

Figure 5. Canoe used to maneuver whales into shallow water for capture. Man on bow is the jumper.

Figure 6 Beluga being driven toward shore.

Figure 7. Captured beluga with lasso around head. NOSC personnel in background assist the collector.

CAPTURE AND RESPONSE TO ON-SHORE HOLDING TANK

Capture

On 1 August 1977, the first whale, a female, was caught. In accordance with capture methodology, she was herded into very shallow water, where the capture was made. After she was lashed to the side of the transport canoe, all participating boats and personnel proceeded to the beach near the on-shore holding tank. Then she was hand-carried across the beach to the tank. In a similar manner, on 3 and 4 August, two male belugas were caught and taken to the holding tank. This completed the 1977 capture operation.

In July and August of 1980 the same methods used in 1977 were used to collect three more whales for NOSC.

Response to On-Shore Holding Tank

The holding tank at the Nanuk Enterprises facility is located on the west bank of the Churchill River. The tank is approximately 20 feet long, 15 feet wide, and 8 feet deep (Fig. 8). Water is pumped directly out of the river into the tank during periods of high tide.

If the whales are captured during high tide, the nearby lagoon (Fig. 9) enables the

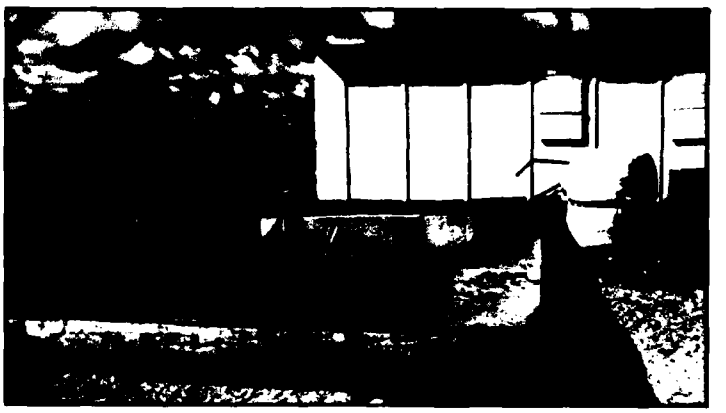

Figure 8. Holding tank near motel. Water is pumped into the tank at high tide.

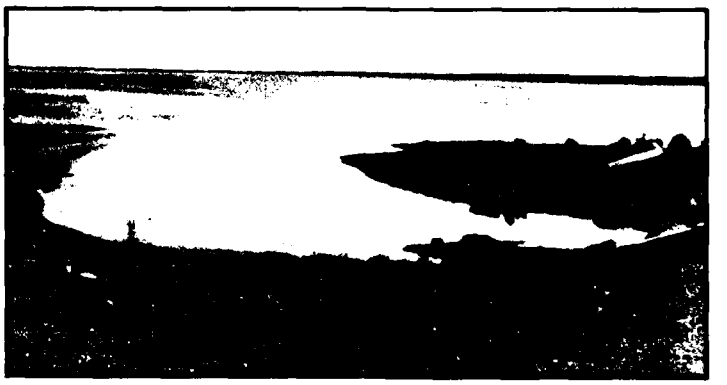

Figure 9 Lagoon at high tide

Figure 10. Captured beluga being carried over the mud flats to holding facility.

Figure 11. Beluga Motel — part of Nanuk Enterprises facility.

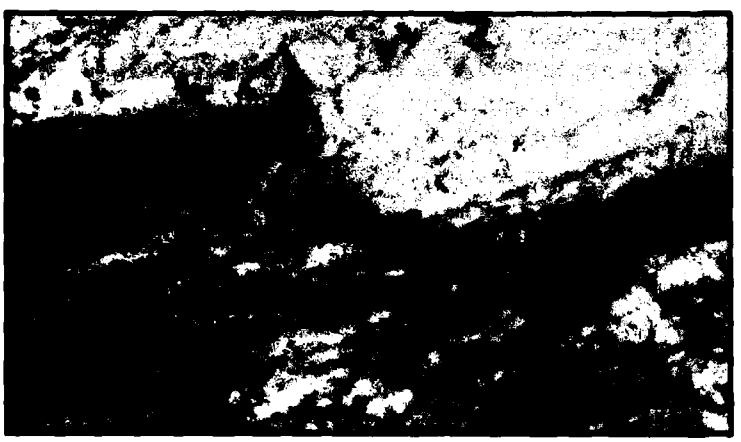

Figure 12. Polar bear eating beluga, which it recently captured. (This photo taken by Don Ljungblad during aerial survey near Point Barrow, Alaska.)

collectors to transport the animals near the holding facility. But if the whales are captured at low tide (Fig. 10), they must be hand-carried several hundred yards to the facility.

Shop space, the equipment storage area, and a number of motel units are also part of the facility (Fig. 11). An 8-foot-high cyclone fence encircles the area around the animal holding tank. This fence provides security from polar bears – which will attack beluga whales (Fig. 12) – and is used to limit visitor access during periods when whales are being held.

When the animals were put into the on-shore holding tank, they rapidly began exhibiting normal breathing patterns (30- to 40-second respiration cycles). They were, however, very skittish, starting at shadows, sounds, and movement by people in the area. Because of turbid water and the fact that the three whales were crowded in the tank, it was not possible to observe the animals feeding, so no attempt was made to induce them to eat during their short stay in the tank at Churchill.

FACTORS AFFECTING WHALE ACQUISITION AND RETENTION

Whale Selection Factors

Selection criteria and whale acceptability were based on sex, size, age, physical appearance, medical examinations, and blood analysis. From 1 through 4 August 1977, four whales were captured by Nanuk Enterprises. Three of these were deemed acceptable for NOSC purposes. The original contract and collecting permits called for two females and one male. Owing to time constraints, weather conditions, animal availability, and transport requirements, sex criteria were waived, and two males and one female were accepted. A capture permit variance was requested by NOSC to allow the substitution of two males for two female whales. The variance was approved by Canadian officials over the telephone. During the collection of 1980, permits were acquired for three females, and three females were taken.

Physical and Medical Examinations

The first cursory examination of the whales was performed at the capture site. Sex, size, approximate age, and general condition were determined before the whales were secured to the canoes. Once the whales were in the holding tank and after they had been observed for 24 hours, a more detailed examination was performed. This physical was required before final acceptance of the whales. Their measurements and weights were taken, sex confirmed, eyes, mouth, and blowhole checked, lungs palpated, and blood drawn for a detailed analysis. If medical examinations or behavioral observations revealed undesirable characteristics, the whales could have been rejected and if time permitted, new whales could have been captured. Except for the fact that more males than females were caught during the first capture, all examination factors were positive.

TRANSPORT OF THE ANIMALS

This section of the report provides the details of the whale transport from the holding tank at the collector's facility in Churchill, Canada, to the Marine Sciences Laboratory (MSL) at NOSC, San Diego, California.

TRANSFER TO AIRCRAFT

The same procedure was followed during both the 1977 and 1980 transport operations. The water was lowered in the holding tank to a depth of approximately 2 feet. Then each beluga was maneuvered into a transport stretcher (Fig. 13). A crane was used to lift each whale from the tank and place it in a transport box (Fig. 14). The box had been preloaded onto a flatbed truck by means of a forklift. When all the whales were loaded into the boxes on the truck, they were driven to the airport, where a forklift and scissors truck was used to move the transport boxes from the flatbed truck into the Navy C-9 aircraft (Fig. 15).

AIRCRAFT TRIP – CHURCHILL TO SAN DIEGO

The transporters were loaded into the aircraft and secured to fuselage tie-down cleats. The aircraft then left Churchill for San Diego.

During the entire flight, the whales were attended to by several NOSC personnel on board. Respiration rates were monitored to detect any early signs of distress. Additionally, each whale was covered with terry cloth and packed with ice around its flippers and tail. The whales were sprayed with water every few minutes during the entire flight to prevent the skin from drying and to aid in the maintenance of a normal body temperature (Fig. 16).

TRANSFER FROM AIRCRAFT TO MARINE SCIENCES LABORATORY

The whales were off-loaded at NAS North Island, positioned on a flatbed truck, and transported to the NOSC Marine Sciences Laboratory. Those handling procedures were almost identical to earlier loading operations at Churchill. Once at MSL, each whale was lifted off the flatbed truck by means of a crane and lowered into a circular tank, 30 feet in diameter and 6 feet deep. Personnel in the tank assisted the whales out of their stretchers. The water was maintained at a shallow level for a short period to assure that the whales were swimming and breathing normally. When released from their stretchers, they immediately began swimming together slowly around the tank. Attempts were made to induce them to

Figure 13. Beluga maneuvered onto stretcher in preparation for transport to San Diego.

Figure 14. Beluga in stretcher being loaded into transport box.

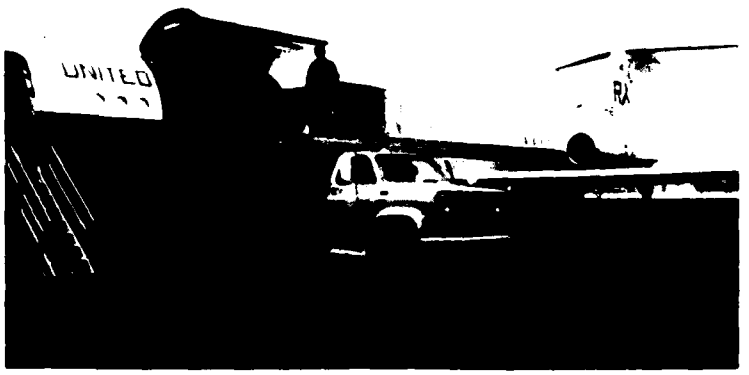

Figure 15. Beluga being loaded into Navy C-9 aircraft.

Figure 16. Beluga being sprayed with water during flight to San Diego.

take fish, but they were not interested. For the handlers of the group captured in 1977, these attempts to condition the whales to eat in captivity marked the beginning of a long, arduous, and often frustrating adaptation phase.

ADAPTATION OF THE ANIMALS

This section provides a general summary of the events leading to the eventual hand-feeding of the first three whales brought to MSL, San Diego.

HAND-FEEDING

With most small-toothed whales, hand-feeding is accomplished within 5 to 10 days of capture. This was not the case with the belugas. In addition to the fact that it was simply more difficult to get the belugas to adapt to captivity, several other factors are believed to have influenced the whales' progress. There normally is a water temperature differential between Hudson Bay and Southern California during the summer months of approximately 15°F. The much warmer water in California could tend to slow the whales' metabolic rate and requirement for food. Furthermore, limited tank space required that the whales be kept in the same enclosure. Consequently, during feeding attempts the whales would become excited, "school up" (group together), and draw security from each other, thus avoiding human contact. Then, too, water circulation in the holding tank tended to limit feeding attempts by the whales, since the vortex created by filter operation would rapidly draw the fish over the tank drain. If the pumping system was shut down, the water visibility would rapidly deteriorate so feeding, if it occurred, could not be observed.

Initially, a variety of fish, including smelt, herring, mackerel, and some squid, totalling up to 100 pounds of fish per day, were tossed into the tank several times each day. The fish were counted and after several hours in the tank were removed, counted again, and discarded. Tossing fish to the whales did not induce feeding, but occasionally the whales would be observed carrying or apparently playing with one or more fish.

After 10 days with no food intake, force-feeding procedures were initiated (see Fig. 17). This turned out to be a formidable task, requiring over 3 months before force of some type was no longer required to induce feeding. Recurrently, during the force-feeding period, several days were devoted to tossing fish toward the whales, but each time they refused to take the fish. During one 3-day period, several hundred live anchovies were kept in the whales' tank (Fig. 18). Live fish have been known to induce other species of captive animals to begin feeding, but this was not the case with the belugas.

Figure 17. Beluga in stretcher being force-fed at NOSC MSL, San Diego, California.

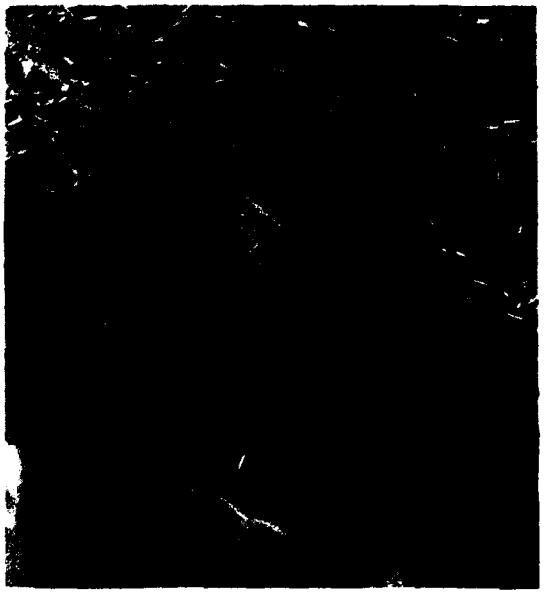

Figure 18. Live bait in beluga's tank, used in an attempt to induce feeding.

Large quantities of ice and fresh water were used to adjust temperature and salinity to approximate the conditions found in Churchill, but that too had no effect on the whales' motivation to accept dead fish. Finally it was decided to use only force-feeding methods and gradually, over a period of time, relax the amount of force exerted.

Twice each day the water level in the holding tank was lowered to a depth of approximately 2 feet. The whales were placed in a stretcher one at a time and were lifted slightly to restrain their movement. Their mouths were held open and mackerel, each weighing from 1 to 1.5 pounds, were pushed past the larynx. If this was not done, the whales would use their tongues to keep from swallowing and then to expel the fish. Gradually, after several weeks, the procedure evolved to a point where fish could be forced into their mouths and then they would swallow on their own (Fig. 19). By lowering the stretcher into the water and relaxing their firm grip on the whale and the stretcher, NOSC personnel exerted less and less pressure until finally the stretcher was no longer used to aid in restraining the whales. The next step was to remove the stretcher, but since physical restraint to prevent the whale from swimming was still required, the water level was lowered to a point where the whale could not swim (see Fig. 20 and 21). With the stretcher removed, several people in knee-deep water would hamper the whale's movement by standing in front and on each side of it. Then its mouth was gently pried open and the fish inserted. As the whales began taking fish in this manner, more water was gradually added to the tank. Eventually the whales began opening their mouths when fish touched their lips. Then progressively more water depth was added and less force was used to hold the whale or block its movement. Finally, forward swimming motion was induced by conditioning the whales to move forward a few inches to take food on their own. It was then a simple matter to increase gradually the distance of the food presentation. This led to conditioned hand-feeding from the tank side with the pool full of water and all personnel out of the tank.

The whales were considered to have adapted to captivity when they would swim to a feeding station with the tank full of water and accept their total daily ration by hand-feeding.

Figure 19. Beluga being force-fed. Animal nearing point of accepting fish without being forced.

Figure 20. Beluga being offered fish in shallow water.

Figure 21. Trainer coaxing beluga to accept fish.

DISCUSSION OF ADAPTATION FACTORS

As stated earlier, several factors are believed responsible for the slow adaptation of the first group of whales. For the second group, collected in 1980, capture and transport procedures and holding facilities were very similar. As in 1977 limited tank space at NOSC precluded separate adaptation areas.

Existing facilities and filter systems necessitated the use of the available seawater supply. The second group also refused initially to take food on their own, but unlike the first group, force-feeding was started within a few days after they were transported to San Diego. Their average age was probably not over 3 years, as opposed to 6 years for the first group, and younger animals generally adapt quicker. When force-feeding was started with the second group, the knowledge gained in 1977 was very helpful. It was not necessary to experiment with different procedures; all that was needed was simply to apply techniques that had earlier been the most effective. This resulted in very systematic force-feeding procedures and significantly reduced the time required to condition hand-feeding.

After completing tank adaptation, the three whales were moved into separate floating pens in 1980 (Fig. 22). Two of the whales began hand-feeding in just a few hours. The third animal refused to hand-feed. After 5 days, she still was not eating, at which point a 20-foot piece of 22-ounce-per-yard vinyl was laced to the inside bottom of the net pen she occupied. The net pen was then pulled up from the normal 10-foot depth to only a 3-foot depth. Personnel entered the water, walked out to the whale, gently restrained her, and offered her fish, which she quickly ate. Within just a few sessions she was hand-feeding from near the pen walkways. The net was then lowered to its original 10-foot depth and feeding was normal from then on.

It was obvious from that experience that a specially configured floating enclosure could be used for the entire adaptation process, thereby eliminating the cumbersome and expensive operation of land-based tank facilities.

A summary of the adaptation process is contained in the Appendix.

Figure 22. Beluga in floating bay pen used in first training area.

CONCLUSIONS

1. Experienced collectors, using specialized equipment and techniques, can capture belugas by herding them into shallow water during periods when they frequent estuaries.

2. Belugas are tough and hardy animals and apparently adapt readily to handling and to captivity, although considerable time and patience are required to get them to feed.

3. Handling and transport can be accomplished by using standard techniques and equipment (e.g., stretchers for lifting and cradling the whales in waterproof boxes during transport). Ice and water can be effectively used to keep the whales cool and wet while they are out of the water.

4. Adaptation of the first three NOSC belugas to feeding in captivity took over 3 months. That period of time was much longer than anticipated and much longer than required for other cetaceans. Several factors, including force-feeding methods, holding-tank configuration, water salinity and temperature, and the fact that the whales were held in the same tank, may account for that relatively long adaptation cycle.

RECOMMENDATIONS

1. Ideally, for initial adaptation, water temperature and salinity conditions should be made comparable to those at the capture location.

2. Belugas should be kept in separate enclosures until they begin feeding.

3. Force-feeding should be initiated within a few days after capture.

4. The force-feeding methods described in this report should be used, but the force applied should be reduced at a quicker rate.

5. Floating pens should be used for adaptation instead of land-based water-filled tanks.

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Appendix
ADAPTATION CHRONOLOGY

Whales in the first group were designated by names. After the second group of whales was captured in 1980, all the project whales were assigned identification numbers (*Delphinapterus leucas* (D1) 574, 575, 576, 637, 638, 639) and a letter (M or F) identifying their sex. Names are still used by the staff, but no longer for identification in reports.

The information that follows comes principally from portions of progress reports covering the 3-month period of tank and floating pen adaptation. To preserve the flavor and immediacy of the original, the present tense is used to describe the adaptation process. As described in the hand-feeding summary, persistence, patience, and gradual relaxation of restraint during force-feeding was the key to stimulate an individual whale's feeding responses.

September 1977. Gradual reduction in forced applications of fish has had very positive effects, stimulating hand-feeding of the smallest and youngest whale, D1-576M. The whales, D1-574F, D1-575M, and D1-576M, are consuming or being fed 12 to 20 pounds of mackerel each for the smallest and largest whale, respectively. D1-574F is hand-feeding. Generally no force is being used to open her mouth. D1-575M still generally requires limited force-feeding measure (i.e., one man stands on each side of the whale, and the pool water is drained to a depth of 18 inches). One hand is often all that is required to open the whale's mouth, then one fish at a time is inserted, which he swallows. Normal hand-feeding is anticipated to take another 7 to 10 days.

October 1977. D1-574F and D1-576M are hand-feeding from the poolside when the tank is full of water. D1-575M has begun to take fish from a trainer standing in waist-deep water. The other two whales initially interfered during this process, so the tank was divided with a barrier during feeding. A standard nylon-fabric, 4-inch mesh, 84-gauge twine crowding net was first used to separate the whales, but they swam into it, apparently not perceiving it or ignoring its presence. A 2-inch by 4-inch, 12-gauge wire mesh barrier 30 feet long, on the other hand, provided a substantial divider. After one initial bumping episode, the whales did not touch the wire fence.

One explanation for the belugas' disregard for net barriers during early adaptation and training may be their natural tendency to swim in, around, and under obstructions found in tidal flats, such as weeds, high grasses, and small trees. To the whales, sonar fabric netting may be close in sound reflectivity to familiar objects in their environment. So, in effect, they have adapted to swimming through low reflective obstructions.

Up to the present time, approximately 3 hours each day per animal has been devoted to the feeding process. It appears that the current food intake of approximately 20 pounds each is sufficient to produce a gradual weight gain in the three whales. They are weighed approximately every 2 weeks. Care will be taken to assure a slow, continued increase in weight since the three whales are sub-adult and require food increases to prevent their growth from being stunted.

November 1977. D1-576M has completed his tank adaptation and on 2 November was moved from his tank at MSL to a floating pen at the project Cold Ops site in San Diego Bay. The animal was transported in the same stretcher and box that was used in the original capture and transport from Churchill, Canada, in early August.

A 24-hour watch was posted during the animal's initial adjustment to the new enclosure. He was not observed to make any contact with the sides of the enclosure. D1-576M started eating on the afternoon of 5 November, approximately 52 hours after being moved. The animal's daily food intake has since increased to 25 pounds.

On 21 November, the second whale, D1-574F, was also moved from her tank to a floating bay pen. As with D1-576M, the move went without incident. However, once placed in the pen, she did bump into the sides of the wire enclosure. Divers were in the water with her (as they had been with D1-576M) to deter aggressive contact with the pen fencing. The butting behavior rapidly regressed to a periodic pushing at the wire with her melon.

A 24-hour watch was maintained. D1-574F slowly adapted and began feeding after 30 hours in her new enclosure. Her behavior in the pen was quite different from that of D1-576M. She displayed a marked preference for staying under the floating walkways, even to the point of coming up to breathe in what is approximately a 6-inch-wide 24-inch-long opening under the walkways between the flotation barrels. She was timed on several occasions breath-holding for up to 10 minutes during the first 24 hours of adaptation in the new enclosure, as opposed to 6 minutes for D1-576M. This extended submergence behavior abated for both animals as they became accustomed to their new habitat.

At the end of the month, after nine days in the pen, D1-574F was eating well and just beginning to display obvious food motivation.

D1-575M has started taking food from the trainer, who is standing at the tank side. By the end of the month, the animal ate all of his food in this manner.

December 1977. On 6 December, D1-575M was moved from the MSL holding tank to the Cold Ops holding pens at Bayside. He started eating on the morning of 8 December. His food intake has since steadily increased. He follows the trainers around his enclosure for food.

Average daily food intake during the month for each whale ranges between 26 and 30 pounds. The whales will be conditioned to eat a variety of fish, including smelt, herring, and mackerel.

Basic training for the belugas will closely parallel what has been done in the past with other species of captive cetaceans. Comparisons of training time, capabilities, and performance will be made with those species. First, recall (pinger) training and then gate training will be initiated, followed by handling and harnessing. When their open-water control training is completed, the first area to be studied will be their deep-diving capabilities.

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